

Appendix 1

**Reconnaissance survey of the geology and
ground-water resources of the proposed
Agate Fossil Beds National Monument,
Sioux County, Nebraska,
May 31, 1966**

Includes a reconnaissance report by the USGS and correspondence between USGS and NPS personnel regarding the proposed location and construction of a water supply well.

May 31, 1966

RECONNAISSANCE SURVEY OF THE GEOLOGY AND GROUND-WATER RESOURCES OF THE
PROPOSED AGATE FOSSIL BEDS NATIONAL MONUMENT, SIOUX COUNTY, NEBRASKA

by

Philip A. Emery
Geologist
U.S. Geological Survey

Geology and General Availability of Ground Water

Rocks ranging in age from Miocene to Quaternary are exposed within the proposed park boundary. The best and most readily available aquifer is the Recent alluvium and adjacent parts of the terrace and colluvial (slope-wash) deposits. (See fig. 1.) This aquifer is capable of yielding small to moderate amounts of water. The lower part of the Arikaree Group (see table 1) would most likely yield the greatest amount of ground water, perhaps as much as 500 gallons per minute. The irrigation well shown on figure 1, in section 5, probably obtains its water from Arikaree rocks. The bottom of the Arikaree Group, or Miocene, within the park boundary, is estimated to be at an altitude of approximately 4,250 feet. Below this contact the possibility of obtaining adequate supplies of good-quality water decreases and is nearly nonexistent below the top of the Pierre Shale of Cretaceous age.

Following is a log of an oil company test hole drilled approximately three-fourths of a mile south of the southeast corner of the proposed park boundary. It is included in this report because the subsurface geology of the park area may be expected to be similar to that at the test-hole site. However, since the park area is at a lower altitude, the stratigraphic contacts designated would be nearer the land surface.

Generalized log of test hole, Union Oil Co. of California, Agate test No. 15-1, drilled August 1938 in NW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 15, T. 28 N., R. 55 W. Altitude of land surface, approx. 4,695 feet, total depth, 6,846 feet.

	Depth below land surface (in feet)	
	From	To
<u>Tertiary System</u>		
Miocene Series		
Arikaree Group.....	0	410
Oligocene Series		
White River Group.....	410	960
<u>Cretaceous System</u>		
Upper Cretaceous Series.....	960	4,625
Lower Cretaceous Series.....	4,625	4,965
<u>Jurassic System</u>		
Upper Jurassic Series.....	4,965	5,409
<u>Triassic System</u>	5,409	5,785
<u>Permian System</u>	5,785	6,846

Chemical Quality of Ground and Surface Water

Analyses of samples of ground and surface water taken in and near the park area indicate that both are of good quality for domestic and irrigation uses. (See table 2.) The water is hard, but should present no problems for the intended uses.

Ground-Water Supply for the Proposed Park Headquarters Area
SW $\frac{1}{4}$ sec. 3, T. 28 N., R. 55 W.

A proposed well site, which was already selected before my arrival at the park area and referred to as Site No. 1, is located on an alluvial-colluvial terrace approximately 250 feet north of the south edge of the terrace which stands 15-18 feet above the present river flood plain. The surface of the terrace is slightly hummocky and has a general slope upward away from the stream 1-2° NNW. The depth to water at this site probably is between 15-20 feet, and the thickness of the alluvial-colluvial fill probably is between 30-50 feet. If an adequate supply of water cannot be obtained from this material, it is possible to drill deeper and obtain the required amount from the underlying bedrock.

The exact site of the proposed septic tank and disposal field was not designated. The location of the tank and disposal field was discussed with Mr. R. C. Wyrick of the National Park Service; and a likely site, based on the general location given on the general-development-plan map and our examination of the topography of the area, was postulated. The direction of ground-water movement in the area of Well Site No. 1 and the disposal field is to the southeast and south toward the Niobrara River. To eliminate any possible chance of contamination to the water supply the disposal field should be located east of a line running N. 15-20° E. of the well site. If possible, either Well Site No. 1 should be moved westward or the disposal site moved eastward to avoid potential contamination.

Ground-Water Supply for Picnic Area near Agate Springs Ranch

Little difficulty should be experienced in obtaining an adequate amount of ground water in the picnic area. The depth to water is only about 5-10 feet and the saturated sediments should be sufficiently permeable to yield small supplies of water. However, inasmuch as a cattle feed lot and recently installed privies apparently are upgradient from the picnic area, strong possibilities exist for contamination of the ground-water supply. To avoid these possibilities of contamination, the well should be installed at a higher elevation to the southwest, perhaps near the proposed storage-tank site. A well installed in this locality would, of course, derive water from the bedrock formations, and depth to water probably would be between 80 and 100 feet.

If it is necessary to install the well within the picnic grounds it should be located as far as possible from the toilets and feed lot, and the water should be periodically sampled and analyzed for contamination.

Table 1.--Generalized section of the Quaternary and Tertiary rocks within the proposed
Agate Fossil Beds National Monument.

System	Series	Stratigraphic unit or subdivision	Approximate thickness (feet)	Character, distribution, and water supply
Quaternary	Recent and Pleistocene	Alluvium and colluvium, undifferentiated	0-50	Flood-plain deposits of clay, silt, sand, and gravel; slope-wash and talus deposits consisting of poorly sorted, locally derived bedrock fragments. (In some areas this material should yield water readily to wells; this is especially true near the river and the adjacent parts of flanking terraces.)
		Harrison Formation	100-400	Gray, poorly cemented, fine-grained sand and silt; some "pipy" concretions in lower part; fossil quarries in lower part; "Devil's Corkscrews" in the upper part.
		Monroe Creek Formation		Reddish-brown to buff sandy silt and clay with layers of thick-bedded gray sand and many "pipy" concretion zones. (Where saturated should yield water readily to wells.)
Tertiary	Miocene	Gering Formation	550-600	Gray, fine- to medium-grained sand, often crossbedded; may or may not be present in Park area. (If present should yield abundant water to wells.)
		Brule Formation		Pink, massive, silty clay, with thin layers of volcanic ash and fine sand. (Yields water only if fractured.)
		Chadron Formation		Green to buff clay and silt; channel sandstone locally found at base. (Yields very little, if any, water to wells.)
Cretaceous	Upper Cretaceous	Pierre Shale Formation	2,500 ⁺	Black and gray clay shale with a few thin sandstone beds in upper part. (Nearly impossible to obtain water from this unit; any obtained would be of poor quality.)

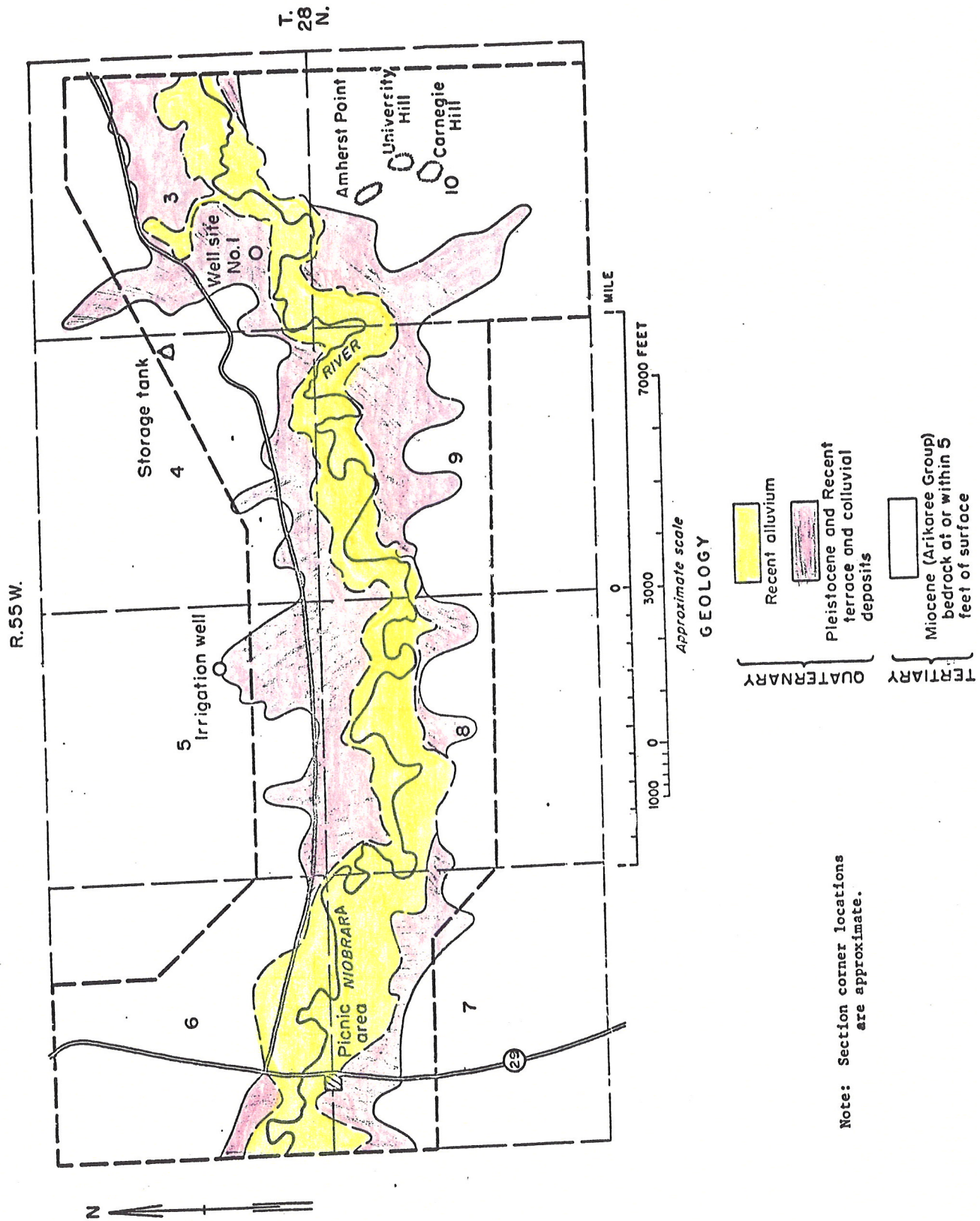


Figure 1.-- Reconnaissance geologic map of proposed Agate Fossil Beds National Monument, June 1966.

Table 2.--Chemical analyses of ground and surface water in the vicinity of the proposed Agate Fossil Beds National Monument.
Analytical results in parts per million except as indicated

Location	Source	Depth of well collection (feet)	Date of collection	Silica (SiO ₂)	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Boron (B)	Dissolved solids	Calcium magnesium	Noncarbonate	Percent sodium	Specific conductance (micromhos at 25°C)	pH
NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 6, T. 28 N., R. 55 W. (Agate, Nebr.)	Quaternary alluvium	13	11-22-36	..	....	47	11	21	...	196	22	5.0	0.6	20	....	223	163	..	..	...	...
SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 6, T. 28 N., R. 54 W. (2 miles E of park)	.....do....	45	10-8-52	50	0.37	45	7.4	20	6.8	192	19	5.5	.7	18	0.04	268	143	0	22	352	8.0
NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 19, T. 29 N., R. 53 W. (8 miles NE of park)	Arikaree Group	207	10-8-52	55	.17	39	7.2	7.8	4.4	161	5.0	5.5	.3	3.6	.02	216	127	0	11	273	8.1
SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 29, T. 27 N., R. 54 W. (10 miles SE of park)	.....do....	165	10-7-52	46	....	46	7.8	7.2	3.5	165	4.0	6.5	1.3	12	.03	238	147	12	9	311	7.9
Niobrara River at Agate, Nebr. 1/	River	....	10-8-52	53	....	..	....	19	8.1	..	....	...	...	....	....	306	183	0	17	419	8.5

1/Estimated flow at time of collection 100 cfs.

1/Estimated flow at time of collection, 10 cfs.

cc:

Superintendent, Fort Collins Bluff w/c of report
Regional Director, NW Region w/c of report
Chief, Branch of Water Resources, WABO
Chief, D&C, SSC w/c of report

SAN FRANCISCO PLANNING AND SERVICE CENTER
Office of Land and Water Rights
450 Golden Gate Avenue, Box 36063
San Francisco, California 94102
June 6, 1966

LS4 LWSSC

Agate Fossil Beds

Morris

Memorandum

To: Mr. Kenneth A. Mac Kichan, District Chief, USGS
Nebraska Hall, 901 N. 17th St., Lincoln, Nebraska 68505

From: Supervisory Hydraulic Engineer, SSC

Subject: Water resources investigations - Agate Fossil Beds

I wish to express our appreciation to you, Mr. Philip A. Emery and Mr. H. M. DeGrew for the cooperation in furnishing this report on the limited advance notice we were able to give you.

We plan to drill a test well, based on Mr. Emery's report, at the proposed Park headquarters as soon as specifications can be issued. The sequence of related activities will probably require the bid opening date be set for early July, 1966.

There was a misunderstanding as to pre-selection of the well site for the proposed Park Headquarters Area. This may have affected the choice Mr. Emery might otherwise have made. In general, the Survey is free to make its own recommendations, selecting sites--based on their professional judgment--that are capable of yielding the end result described by us. We may, in some cases, ask you to consider a preferred location along with your own recommendation. The pre-selected site, Well No. 1, was just such a case. In view of the reservations Mr. Emery makes in the final two sentences on Page 3, would he prefer another location?

Your assistance will soon be requested for supervision of the drilling and testing. Thanks again.

(Sgd) MANUEL MORRIS

Manuel Morris

cc:

Superintendent, Scotts Bluff w/c of report
Regional Director, MW Region w/c of report
Chief, Branch of Water Resources, WASO w/c of report
Chief, D&C, SSC w/c of report

MMorris:pm



UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240



IN REPLY REFER TO:

June 17, 1966

L54-SLW

Memorandum

To: Supervisory Hydraulic Engineer, SSC

From: Chief, Branch of Water Resources

Subject: Water Resources Investigations, Agate Fossil Beds

San Francisco Field Office Office of Biological Resources NATIONAL PARK SERVICE	
JUN 20 1966	
ACT. INFO.	INITIALS/DATE
CHIEF	
ASST. CHIEF	
SUPV. APPR.	
SUPV. Hyd. Eng.	

Please refer to your memorandum of June 6 to Mr. Mac Kichan, U. S. Geological Survey and the report by Mr. Emery on the ground water resources of Agate Fossil Beds National Monument.

Although the author describes the Recent alluvial and associated deposits as the "best" aquifer, the data in the report suggests that the Arikaree is the best. The Recent alluvial deposits are "capable of yielding small to moderate amounts of water" whereas the Arikaree "would most likely yield the greatest amount of ground water." The analyses in table 2 show very little difference in quality of water from the two aquifers with perhaps the water from the Arikaree being slightly less mineralized.

The only advantages in tapping the Recent alluvium rather than the Arikaree is the lesser depth of the well and possibly a lesser lift to the surface. If the water needs of the monument are not great these may outweigh the greater yield of the Arikaree. However, the author raises the possibility of pollution from the septic tank. A well into the Arikaree, properly cased and cemented through the Recent deposits, would be safe from such pollution.

Your memorandum indicates that a test well will be drilled in early July. You should consider testing both the Recent deposits and the Arikaree before a production well is decided upon.

Thank you for sending us a copy of the report. We shall be interested in the proposed test well and, also, in view of your memorandum, in learning whether Mr. Emery changes his recommendations.

E. W. Reed
E. W. Reed

cc:
Regional Director, Midwest
Superintendent, Scotts Bluff



IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Water Resources Division
Room 127 Nebraska Hall
901 North 17th Street
Lincoln, Nebraska 68508
June 20, 1966

Firm

AIRMAIL

Memorandum

To: Manuel Morris, Supervisory Hydraulic Engineer, SSC
Office of Land and Water Rights, NPS, San Francisco, Calif.

From: District Chief, WRD, Lincoln, Nebr.

Subject: Water resources investigations - Agate Fossil Beds

In reference to your letter of June 6, it is my opinion that maximum protection from contamination would be achieved if well site #1 were moved at least 1,000 feet due west of the preselected site.

FOR THE DISTRICT CHIEF:

Philip A. Emery
Philip A. Emery

cc: Richard Holder, Superintendent
National Monument
Scotts Bluff, Nebr.

SAN FRANCISCO PLANNING AND SERVICE CENTER
Office of Land and Water Rights
450 Golden Gate Avenue, Box 36063
San Francisco, California 91402
June 23, 1966

LS4-LWSSC
(General-AGFO)

Memorandum

gm
Morris

To: Assistant Director, Specialized Services
Attention: Chief, Branch of Water Resources

From: Supervisory Hydraulic Engineer, L&W, SSC

Subject: Water Resources Investigations, Agate Fossil Beds

Further to our recent exchange on well sites at the subject area, USGS Geologist Philip A. Emery advises, ". . . it is my opinion that maximum protection from contamination would be achieved if well site #1 were moved at least 1,000 feet due west of the pre-selected site."

Your memorandum of June 17, raises the question of choice of aquifers. The requirement is for 20 to 50 gpm and, if test drilling the recent alluvials fails to yield these quantities, drilling would be expected to continue, at the same site perhaps, into the Arikaree. The specifications and bid schedule will be designed to accommodate this contingency.

By copy of this memorandum, the Chief, D&C, SSC is being advised that the test well site will be relocated in accordance with Mr. Emery's recommendation, unless we receive contrary advice.

(sgd) MANUEL MORRIS

Manuel Morris

cc: Regional Director-MWR
Superintendent, Scotts Bluff

MMorris:11

Appendix 2

Memo describing construction of Well #1, July 19, 1968

Memo report describing construction and testing of a water supply well at the park.
includes a detailed geologic log



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USIS

UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Water Resources Division
Rm. 127, Nebraska Hall
901 North 17th Street
Lincoln, Nebraska 68508
July 19, 1968

IN REPLY REFER TO:

RECEIVED	
San Francisco Planning and Service Center Office of Land and Water Rights NATIONAL PARK SERVICE	
JUL 22 1968	
ACT. INFO.	INITIALS DATE
<input checked="" type="checkbox"/> CHIEF	<i>EM</i>
<input checked="" type="checkbox"/> ASST. CHIEF	
<input type="checkbox"/> STAFF ASST.	
<input type="checkbox"/> SUPV. APPR.	
<input type="checkbox"/> PRE-ACQ'N.	
<input type="checkbox"/> TITLE	
<input type="checkbox"/> EXCHANGE	
<input checked="" type="checkbox"/> Supv. r.y.d. Eng.	
<i>Robert B. 9-20 7/23</i>	
<i>Marcia</i>	
<input type="checkbox"/> DOCKET	
<input type="checkbox"/> FILE	

Memorandum

To: Mr. J. W. Roberts
National Park Service
San Francisco, Calif. 94102

From: District Chief, WRD
Lincoln, Nebr.

Subject: Agate Fossil Beds, Nebraska

In accordance with your request that this office supervise the drilling and test of Well #1 at the Agate Fossil Beds site the following is submitted. Information thus contained is for administrative use. No formal report is contemplated.

The test was conducted at the location of NW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 3, T. 28 N., R. 55 W. in Sioux County. The well was drilled in July 1967 and tested for performance August 7-9, 1967. Samples of the rock materials drilled were obtained. The upper 89.5 feet was sampled by H. M. DeGraw, geologist. The driller, George Snyder, caught samples from 89.5 feet to the 193-foot depth. Difficulties with mud circulation attributed to fracture zones occurred during the drilling. Circulation was lost a number of times, particularly at a depth of 41 feet, 66 feet, and 193 feet. At the 66-foot depth it was necessary to fill the 4-inch test hole with concrete and redrill with an 8-inch bit with which the hole was finally completed to the 240-foot depth.

A description of the drill samples is attached. Microscopic examination in the laboratory was made by H. M. DeGraw who has been making an intensive study of the Tertiary rocks of northwest Nebraska.

The completed well was cased with 6-inch I.D. steel pipe to a depth of 240 feet. The lower 100 feet of casing was slotted to provide entrance of ground water to the well.

The well was test pumped at 160 gallons a minute for a period of 30 hours. The static water level was 36.33 feet below the top of the casing. The pumping level after 30 hours was 133 feet below the top of the casing, drawdown being 97 feet. The water was clear and appeared to be free of sediment and had excellent taste. Samples of the water were obtained for chemical-quality analysis given in the attached table.

It is my opinion that the well is capable of 150 gallons a minute sustained yield. The pump could be set at about the 200-foot depth below the top of the casing; this would allow ample space below the intake to serve as a sump for sediment that might be drawn into the well.

FOR THE DISTRICT CHIEF:


Chas. F. Keech

Attach. 2

Agate Test #1 Microscopic Analysis
H. M. DeGraw
July 10, 1967

<u>Description</u>	<u>Depth, in feet</u>	
	<u>From</u>	<u>To</u>
Quaternary		
Holocene and Pleistocene		
Topsoil.....	0	1±
Sand, very fine to fine, predominantly very fine; slightly silty, noncalcareous.....	1±	7
Sand, very fine to fine, predominantly very fine; slightly silty, noncalcareous; trace of calcite.....	7	12
Sand, clean, very fine to fine with pieces of limestone, sandstone, and medium gravel; probably very slightly calcareous from 15-16 ft.....	12	16
Sand and gravel, predominantly very fine to medium; mostly gravel and pebbles (of limestone and calcareous cemented sandstone); predominantly very calcareous.....	16	20
Tertiary		
Miocene		
Arikaree Group		
Harrison Formation (?)		
Sand, predominantly very fine to fine; some medium to coarse with white soft lime; grayish-brown; non to very calcareous.....	20	23
Circulation sample		
Sandstone, predominantly very fine to fine with medium, light brownish-gray; lime-cemented and limestone, white, gray, some pebbles.....		23
Sand, predominantly very fine to fine, grayish-brown with soft white limestone pieces; predominantly noncalcareous.	23	28
As above.....	28	34.5
Interbedded (34.5-35.5 is sand).....	34.5	43
Sand, predominantly very fine to fine, grayish-brown and hard white limestone layers, non to very calcareous		
Losing circulation and lost circulation at 41 ft.		
Circulation sample		
Limestone, white and sandstone, very fine to fine, silty, light-gray and soft sandstone, light-brown, very fine to fine, very slightly calcareous.....		43
Limestone, hard, sandy, very fine to fine, very light gray, very calcareous.....	43	46

	<u>Depth, in feet</u>	
	From	To
Harrison Formation (?)--Continued		
Sandstone, soft, predominantly very fine to fine, slightly calcareous (white limestone may be lag from above).....	46	47
Interbedded, (47-48 hard, 48-50 soft), grayish-brown, sand and sandstone with lime cement; predominantly very fine to fine sand; slightly to very calcareous.....	47	50
Interbedded sand and sandstone; predominantly very fine to fine, grayish-brown; slightly silty; slightly to very calcareous.....	50	54
Monroe Creek Formation		
Hard sandstone, lime-cemented; predominantly very fine to fine; light-gray; very calcareous.....	54	58
Sand, very fine to fine; possibly slightly silty; slightly calcareous.....	58	62
Lost circulation		
No sample with 4" bit; changed to oversized 8" bit.....		
(Poor sample) Sand with white limestone pieces, predominantly very fine to fine with some medium and coarse, probably from cement plug; slightly calcareous.....	62	64.5
Circulation sample		
(Sand and gravel and pebbles from cement plug)		
Sandstone, very fine to fine, noncalcareous, light-brown..		
Sandstone, very fine to fine, moderately to very calcareous, very light gray; limestone, white, very calcareous.....		64.5
Sand, soft, brown, predominantly very fine to fine; trace of limy pieces; very slightly calcareous.....	64.5	67
Sandstone, hard, predominantly very fine to fine with white limy pieces, light brownish-gray, (poor sample ?); much medium to very coarse sand, which may be lag, slightly to very calcareous.....	67	68
Sand, soft, brown, predominantly very fine to fine, some coarser sand, probably from cement plug, non to very slightly calcareous.....	68	69
(Two samples) Interbedded, noncalcareous		
Sand, predominantly very fine to fine; brown; sandstone very fine to fine; non to medium calcareous.....	69	72
Sandstone, moderately hard, predominantly very fine to fine, some medium to coarse (lag ?); brown; slightly calcareous.....	72	75
Sand, soft; predominantly very fine to fine with trace of medium; trace of white limy sandstone; brown; non to slightly calcareous.....	75	78

	Depth, in feet	
	From	To
Monroe Creek Formation--Continued		
Sandstone, hard; predominantly very fine to fine with some medium to coarse (lag ?); some white limy pieces; brown; slightly calcareous.....	78	80
Interbedded (80-81 and 82-83 soft; 81-82, hard)		
Sand and sandstone; predominantly very fine to fine, with trace of coarser, some moderately calcareous; cemented, brown, non to slightly calcareous.....	80	83
Sandstone, hard; predominantly very fine to fine, with trace of coarser sand; brown; some moderately calcareous, mostly non to slightly calcareous.....	83	85
Circulation sample		
Sandstone, very fine to fine; predominantly slightly silty; very light brownish-gray; slightly to moderately calcareous.....		85
Sandstone, hard, trace of medium to coarse; predominantly very fine to fine; slightly silty; light-brown; very calcareous.....	85	89.5
Sandstone; light brownish-gray and light brown; slightly to very calcareous.....	89.5	90
Sand; predominantly very fine to fine with dark minerals; slightly silty, trace of white limy sandstone; light-brown; noncalcareous.....	90	93
Interbedded.		
Sand; predominantly very fine to fine; slightly silty with black minerals; light-brown; noncalcareous; with white limestone pieces and sandstone, soft, lime-cemented, moderately calcareous, light brownish-gray.....	93	100
Sand, trace coarser, very fine to fine; predominantly noncalcareous; some white limy pieces with sandstone, moderately calcareous.....	100	104
Sand, soft, predominantly very fine to fine with trace of coarser; few lime-cemented pieces; light-brown; noncalcareous.....	104	111
Sandstone, hard, predominantly very fine to fine; slightly silty; light brownish-gray; moderately to very calcareous.	111	112
Sandstone, soft, as above, slightly silty.....	112	113
Sand, soft, as above, trace of coarser sand; slightly silty; light brownish-gray; moderately calcareous.....	113	125
Sand, predominantly very fine to fine, slightly silty with limy pieces (small sand size); light-brown; noncalcareous.	125	133
As above (limy pieces are probably in limestone layers).....	133	139
Sand, predominantly very fine with fine; moderately silty with limy pieces; light-brown; slightly calcareous.....	139	145
As above.....	145	153

Depth, in feet
From To

Monroe Creek Formation--Continued

Sandstone, predominantly very fine to fine; slightly silty with hard white limestone pieces (layers); light-brown; noncalcareous.....	153	166
Sandstone, soft to hard; predominantly very fine to fine; moderately silty with hard white limestone pieces (layers); non to very calcareous; and sand, light-brown and white to very light-gray.....	166	187
(No sample), probably sandstone and limestone.....	187	193
Fracture zone.....		193
No samples collected.....	193	240
Total depth of test well.....		240

Samples are stored at the Conservation and Survey Division of the University of Nebraska, Room 113 Nebraska Hall, 901 North 17th Street, Lincoln, Nebr. 68508.

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Well Location 28N55W13cb 42°23'50"N Long. 103°41'41" Depth of sample, 240 ft.						
Date of collection		Aug. 8, 1967				
Silica (SiO ₂)	56					
Iron (Fe)	--					
Manganese (Mn)	--					
Calcium (Ca)	36					
Magnesium (Mg)	7.9					
Sodium (Na)	13					
Potassium (K)	6.7					
Bicarbonate (HCO ₃)	163					
Carbonate (CO ₃)	0					
Sulfate (SO ₄)	13					
Chloride (Cl)	3.1					
Fluoride (F) .....	.5					
Nitrate (NO ₃)	13					
Dissolved solids						
Calculated	229					
Residue on evaporation at 180°C .	248					
Hardness as CaCO ₃	122					
Noncarbonate hardness as CaCO ₃ ..	0					
Alkalinity as CaCO ₃	134					
Specific conductance (micromhos at 25°C)	332					
pH	7.3					
Color	5					
Boron .....	.03					
SAR .....	.5					

Appendix 3

**Memo and responses;Water questions from
Agate Fossil Beds National Monument,
May 9, 1986,
August 27, 1986,
October 10, 1986,
October 23, 1986**

A memo from the park to the Water Resources Division raising several issues and concerns regarding the parks water resources and water rights. Several memos from the Water Resources Division respond to the questions and issues raised by the park.

memorandum

DATE: May 9, 1986

REPLY TO
ATTN OF: Superintendent, Scotts Bluff and AGate Fossil Beds National Monuments

SUBJECT: Water Questions, Agate Fossil Beds National Monument

TO: Dick Ketcham.

Enclosed are copies of most of what we have for water at Agate Fossil Beds which as you can see isn't much. We have had a number of questions regarding water and water resources at Agate. Among them are:

1. Since the National Park Service has taken over the area, great changes have occurred in the river environment. Large marsh areas have formed and in many places it is difficult to determine the main channel of the River. Are these changes the result of natural action, the removal of heavy cattle grazing in the area, termination of dredging, elimination of the impact of historic grazers, the result of periodic tumbleweed dams, or all of the above? What actions should we be taking in regard to the management of this small river?
2. What are the effects upon the river within the park originating outside the park? What is the quality of the river water? Is it heavily laden with pesticides? What is the effect of irrigation on levels of the river?
3. Do we in fact have any rights in regard to the water in the river or is our major guarantee of in stream flow predicated on the fact that there are senior water rights down stream?
4. We are often accused of causing great loss of irrigation water due to evaporation and transpiration from the marsh area. Is this true?
5. Much of the upstream river area within the park boundaries lie within an area in which the Federal Government holds scenic easement only. We suspect from reading the easement that its terms would not prevent center pivot irrigation equipment from being installed in the park. If this is so should the easement be strengthened? What would the likely effect on the river be if such equipment were installed?
- #6 What is the current status of surface versus ground water laws? Are we sufficiently protected to insure the future domestic water needs of the Monument?

Naturally we do not expect complete answers to these questions, but we do feel we have largely ignored the water resources within the Monument from management's standpoint. Any help your office can give us would be greatly appreciated.

Samy Banta

August 27, 1986

L54 (479)
MWR/AGFO Water Rights

Memorandum

To: Jerry Banta, Superintendent, Agate Fossil Beds National Monument
Attn: John Kapler, Management Assistant

Through: Chief, Water Resources Division, Fort Collins

From: Chief, Water Rights Branch, Water Resources Division

Subject: Water Rights Issues in Agate Fossil Beds National Monument

Attached is the status sheet regarding water rights issues at Agate Fossil Beds National Monument. This form presents a concise statement of the issue and the action this office is taking to help solve questions raised by you and your staff.

Please contact myself or Scott Brown if you have any questions.

Stanley L. Ponce

Stanley L. Ponce

Attachment

cc: D. Scott Brown, WRB
Warren Hill, MWR
Michael Ruggiero, MWR

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WATER RIGHTS BRANCH INFORMATION TRACKING SYSTEM

ISSUES AND CONCERNS

August 25, 1986

REGION: Rocky Mountain UNIT: AGFO DATE RECEIVED: 5 - 9 - 86 MODE: memorandum

CONTACTS:

Name Jerry Banta Title Superintendent, SCBL Phone 306/436-4340

Name John Rapier Title Management Assistant, AGFO Phone 306/668-2211

Name Mike Ruggiero Title Chief Scientist, NWR Phone 402/221-3431

WRB Lead Contact Scott Brown

LAST UPDATE: - -

ISSUE/CONCERN:

A few irrigators below the Agate Fossil Beds National Monument assert that the Park Service's management practices have created a condition whereby increased surface evaporation and transpiration have diminished the river's flow to the extent that their irrigation rights have been impacted.

Since the monument was created in 1965, cattle grazing and other historical land use practices have been excluded from the area. The riparian vegetation has changed significantly, causing changes in the Niobrara River's channel configuration. The river meanders approximately six miles through the monument.

The issue has raised other closely related questions concerning water rights and the monument's water resources. Discussions with the Superintendent and Management Assistant during field investigations by Dick Ketcham and Scott Brown, August 12-14, resolved a number of concerns expressed in the superintendent's memorandum of May 9. Those remaining in addition to the principal issue alluded to above are as follows.

1. Does the monument have a legitimate claim for instream flow rights?
2. To what extent are instream flows assured by the existence of senior appropriated water rights downstream?
3. Assuming that some one planning to irrigate lands might apply for a right to appropriate water immediately above the monument, what state process would be followed; what are the Park Service's rights with respect to due process; and what are the obligations and responsibilities of park managers and the Water Rights Branch, respectively?

4. What actions must be taken, if any, to assure that the water rights acquired by the Service when the Hoffman ranch was purchased are not declared abandoned by the state?

ACTION PLAN:

The Water Rights Branch will evaluate the historic trends of the river's flow and will research the Superintendent's questions concerning instream flow rights, due process, and the Hoffman water right. The following actions will be carried out.

1. Examine the hydrologic trend of the upper Niobrara River using gaging records of three stations:
 - a. at the Wyoming - Nebraska border (06454000)
 - b. at Agate Nebraska (06454100)
 - c. above Box Butte Reservoir (06454500)
2. Seek legal advice from the Solicitor concerning the possibility of transferring an acquired right for irrigation to an instream flow right in Nebraska.
3. Obtain from the state of Nebraska a list of decreed water rights for the mainstem of the Niobrara River, listed according to priority.
4. Display the process for appropriating water in Nebraska; the process for objecting to applications for new water use permits; the responsibilities of park managers and the Water Rights Branch; and recommend actions needed, if any, to secure water rights that were acquired when the Hoffman ranch was purchased.
5. Draft report.
6. Review for draft report by Regional Park and WRB staff.
7. Submit final report

ACTION SCHEDULE

Action	Due Date	Completion Date	Responsible Person(s)
1	Sept. 15		Scott Brown
2	Sept. 15		Scott Brown
3	Sept. 20		Scott Brown
4	Sept. 20		Scott Brown
5	Sept. 25		Scott Brown
6	Sept. 29 - Oct. 10		WRB, MWR, AGFO/SCBL
7	Oct. 17		Stan Pence

AGFO

October 10, 1986

L54 (479)

MWR/AGFO Water Rights

Memorandum

To: Superintendent, AGFO
Attn: John Rapiar, Management Assistant

Through: Chief, Water Resources Division
Thomas W. Locke

From: Chief, Water Rights Branch

Subject: Water Rights Issues in Agate Fossil Beds National Monument

This memorandum is our report to you concerning water right issues at Agate Fossil Beds National Monument.

The questions and concerns that were identified by our action plan of August 25, 1986, have been researched and we submit the following information and recommendations for your consideration.

Item 1

Examine the hydrologic trend of the upper Niobrara River using the gaging records of three stations:

- a. at the Wyoming-Nebraska border (06454000);
- b. at Agate, Nebraska (06454100); and
- c. above Box Butte Reservoir (06454500).

RESULTS

Data from two of the above USGS gaging sites on the upper Niobrara River were gathered. The gage at Agate is located slightly above (upstream of) the monument, approximately 300 feet from the Highway 29 bridge. Records for this site are available from 1957 to the present. The gage above Box Butte Reservoir is located below (downstream of) the monument, approximately one mile upstream of the reservoir's high water line. Records for this station are available from 1947 to the present.

We gathered and examined the following types of data from each site:

- a. normal monthly mean discharge;
- b. cumulative monthly runoff;
- c. normal annual mean discharge;
- d. flow duration data;
- e. lowest and highest mean discharge for selected numbers of consecutive days; and
- f. mean daily discharge.

We recognized early that the data collected would not lend themselves to determining whether the river's flow has diminished measurably over the past two decades because of management practices within the monument. The gaging site above Box Butte Reservoir is located approximately 20 miles below the eastern boundary of the monument and between them are many unknown factors that affect the stream's flow regime.

Among the unknown factors are many that can produce significant and unpredictable changes to the flow regime. Examples include:

- a) the timing and volume of irrigation withdrawals;
- b) variable climatic conditions;
- c) the contribution of ground water to surface flow or vice versa; and
- d) impoundments on tributaries.

Those and probably other limiting factors preclude us from ascertaining with any degree of statistical certainty that a man-induced cause-effect relationship does or does not exist between land use practices within the monument and the flow regime of the Niobrara River.

Although it is our position that the limitations of these data do not allow a statistically valid conclusion to be drawn, our thorough analysis of the data and our understanding of the situation have led us to observe some trends and form some opinions. We will share them with the understanding that while they were derived through careful analysis, they are merely the observations and opinions of three professionals.

Please refer to Table 1, Mean Monthly Discharge of the Niobrara River at Two Gaging Stations (May-September). It compares each station's historical (pre-monument) mean monthly discharge with the mean monthly discharge of the periods 1967-1985 and 1976-1985. (Historical records for the station at Agate began in 1958; for the station above Box Butte Reservoir they began in 1947.)

The period 1976-1985 was selected because we assumed that the riparian vegetation within the monument would have established itself between 1965 and 1976. The months of May through September were separated from the remainder of the year because they coincide with the irrigation season and because evaporation and transpiration are greatest during those months.

Comparing historical discharge records (unbroken lines) with the discharge records of two recent periods (broken lines), we note the following observations.

- a. May's flows during the two recent periods (1967-1985 and 1976-1985) have been slightly greater than those of the historical period, both above and below the monument.

- i. May's average discharge at Agate was 13.9 cfs for the historical period (1958-1966), 14.78 cfs for the 1967-1985 period, and 14.84 for the 1976-1985 period.
 - ii. May's average discharge at the downstream site was 29.7 cfs for the historical period (1947-1966), 31.3 cfs for the 1967-1985 period, and 32.0 cfs for the 1976-1985 period.
- b. June's historical flows were greater than those of the recent periods, both above and below the monument.
- i. June's average discharge at Agate was 9.8 cfs for the 1976-1985 period, 10.4 cfs for the 1967-1985 period, and 10.8 cfs for the historical period. The differences constitute a 4-9 percent reduction of flow over the past 10- and 20-year periods.
 - ii. June's average discharge at the downstream site was 18.8 cfs for the 1976-1985 period, 20.9 cfs for the 1967-1985 period, and 26.6 cfs for the historical period (1947-1966). The differences constitute a 21-29 percent reduction of flow at the downstream site in June over the past 10- and 20-year periods.
- c. July's historical flows were significantly greater than those of the recent periods, both above and below the monument.
- i. July's average discharge at Agate was 7.6 cfs for the 1976-1985 period, 8.1 cfs for the 1967-1985 period, and 9.8 cfs for the historical period (1958-1966). The differences constitute a 17-22 percent reduction of flow above the monument in July over the past 10- and 20-year periods.
 - ii. July's average discharge at the downstream site was 14.1 cfs for the 1967-1985 period, 14.5 cfs for the 1976-1985 period, and 19.9 cfs for the historical period (1947-1966). The differences constitute a 27-29 percent reduction of flow at the downstream site in July over the past 10- and 20-year periods.
- d. August's flows have shown remarkable stability from one period to another both above and below the monument.
- i. August's average discharge at Agate was 7.80 cfs for the 1967-1985 period, 7.85 cfs for the historical period (1958-1966), and 7.86 for the 1976-1985 period.

- ii. August's average discharge at the downstream site was 15.0 cfs for the 1967-1985 period, 16.2 cfs for the historical period (1947-1966), and 17.4 cfs for the 1976-1985 period. The difference between the 1976-1985 period and the historical period constitutes a seven percent increase of flow in August below the monument.
- e. September's flows during the two recent periods (1967-1985 and 1976-1985) have been slightly greater than those of the historical period, both above and below the monument.
 - i. September's average discharge at Agate was 7.9 cfs for the historical period (1958-1966), 8.1 cfs for the 1976-1985 period, and 9.1 cfs for the 1967-1985 period.
 - ii. September's average discharge at the downstream site was 11.4 cfs for the historical period (1947-1966), 13.5 cfs for the 1967-1985 period and 14.1 cfs for the 1976-1985 period. The differences constitute an 18-24 percent increase of flow below the monument in September over the past 10- and 20-year periods.

Please refer also to Table 2: Summary of Mean Monthly Discharge and Percent Change from Historical Mean for Two Recent Periods of Two Gaging Stations.

TABLE 1. MEAN MONTHLY DISCHARGE OF THE NIOBRARA RIVER
AT TWO GAGING STATIONS (MAY-SEPTEMBER)

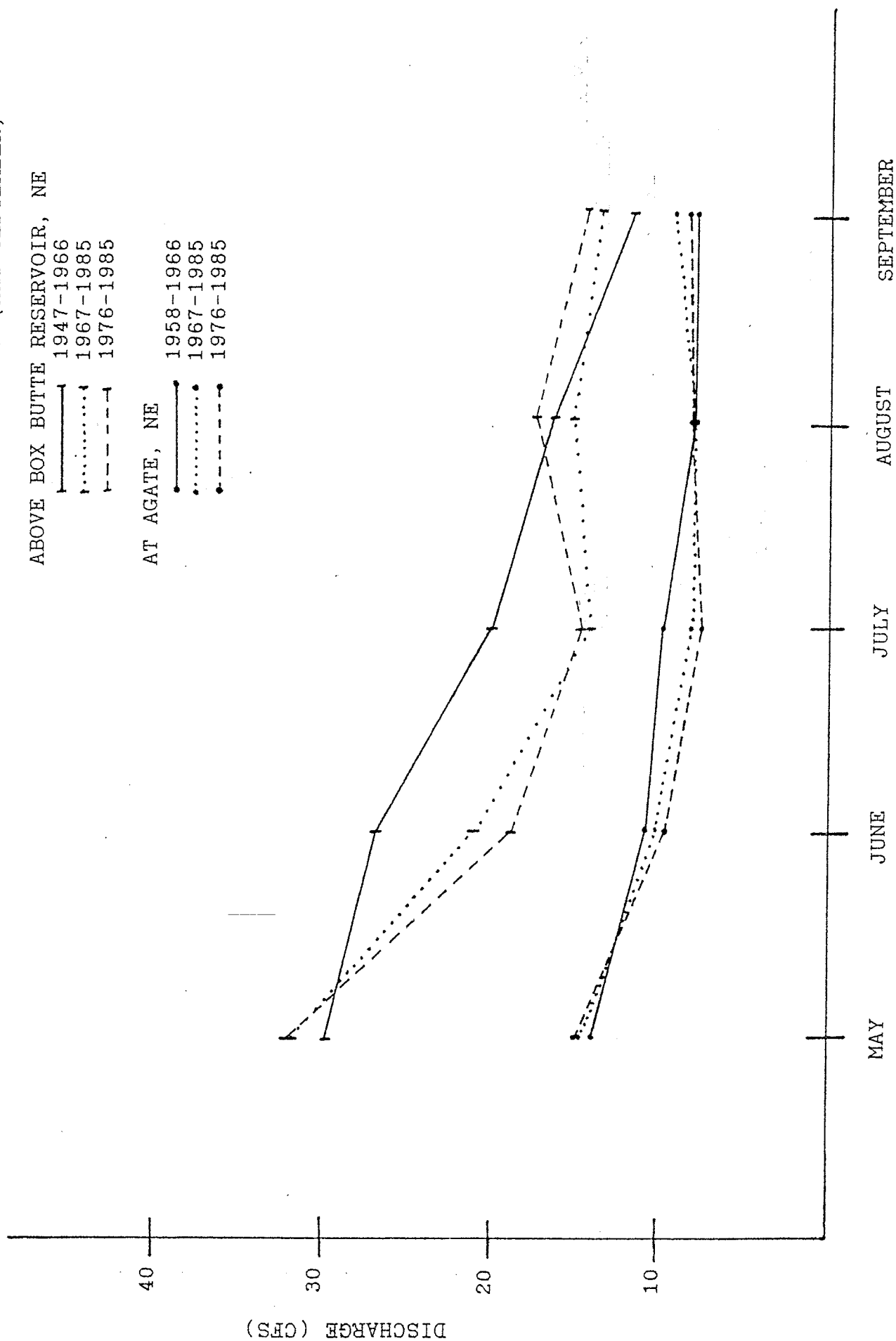


TABLE 2.
Summary of Mean Monthly Discharge
and Percent Change from Historical Mean
for Two Recent Periods at Two Gaging Stations

	Agate	Percent Change	Box Butte	Percent Change
MAY				
Historical	13.9		29.7	
1967 - 1985	14.8	+7 %	31.8	+7 %
1976 - 1985	14.8	+7 %	32.0	+8 %
JUNE				
Historical	10.8		26.6	
1967 - 1985	10.4	-4 %	20.9	-21 %
1976 - 1985	9.8	-9 %	18.8	-29 %
JULY				
Historical	9.8		19.9	
1967 - 1985	8.1	-17 %	14.1	-29 %
1976 - 1985	7.6	-22 %	14.5	-27 %
AUGUST				
Historical	7.9		16.2	
1967 - 1985	7.8	-1 %	15.0	-7 %
1976 - 1985	7.9	0	17.4	+7 %
SEPTEMBER				
Historical	7.9		11.4	
1967 - 1985	9.1	+15 %	13.5	+18 %
1976 - 1985	8.1	+3 %	14.1	+24 %

(Discharge values in CFS)

SUMMARY AND CONCLUSION

Flow data were obtained from two USGS gaging stations located above and below the Agate Fossil Beds National Monument. Much of the data was analyzed after being grouped into specified periods. Data that are representative of an historical period (pre-1966) and data that are representative of two subsequent periods (1967-1985 and 1976-1985) were compared; however, many intervening factors, which are largely unknown, impose severe limitations on the usefulness of these flow data for the purpose sought. We have, nevertheless, offered some observations and expressed our professional opinion with respect to the analysis. They are summarized as follows.

Mean monthly discharge records from the two gaging stations follow closely corresponding trends: Historical flows were greater than recent flows in June and July, but recent flows have been equal to or greater than historic flows in May, August, and September.

July's historical flows below the monument were 27 percent greater than flows recorded over the past 10 years. Such a reduction of flow is significant; however, it is important to note that July's historical flows above the monument (at Agate) were also significantly greater (22 percent) than those of the past 10 years. It is plausible that such a reduction of flow might have been perceived by irrigators below the monument, but a similar reduction occurred above the monument as well.

A comparison of August's flows at the two gaging sites is also noteworthy. August's flows for the 1976-1985 period below the monument were 7 percent greater than those of the historical period. Yet, August's flows above the monument show small variation over the entire period of record.

Finally, September's flows for the 1976-1985 below the monument were substantially greater (24 percent) than those of the historical period. Above the monument the change was not as great (3 percent).

The assertion that a diminishment of flow has occurred below the monument since 1966 and, further, that management practices within the monument have caused the flow to diminish, particularly in the late summer, is an assertion that ignores two points which we have emphasized and which are supported by the flow records. They are:

1. The reduction of flow that has occurred in June and July, since the monument was established, has occurred above the monument as well as below it.
2. -A reduction of flow has not occurred in the late summer period, despite the fact that irrigation demand and evapotranspiration are often at their peak during that period. Recent August and September flows have been equal to or greater than historical flows, both above and below the monument.

We conclude that the data cannot support such an assertion and we would gladly share any of the additional data that we have gathered and examined.

Item 2

Seek legal advice from the Solicitor concerning the possibility of transferring an acquired right for irrigation to an instream flow right in Nebraska.

RESPONSE

This possibility was raised before it was learned that Nebraska has no provision for changing the purpose of a water right. Therefore, advice from the Solicitor's office regarding a change in use has not been sought. Instead, we refer you to the attached excerpts from Nebraska's surface water laws concerning instream appropriations (Section 46-2, 107-116, R.R.S., Nebr., 1985).

We suggest that serious consideration should be given to the possibility of operating within the framework of Nebraska's statutes to protect instream flows within the monument. If it is your desire to pursue an instream appropriation in the manner allowed by the state, the Water Rights Branch will initiate the process in cooperation with the Regional Office and the Solicitor's Office.

Item 3

Obtain from the State of Nebraska a list of decreed water rights for the mainstem of the Niobrara River, listed according to priority.

RESPONSE

The most recent listing of appropriations from the mainstem of the Niobrara River is found in the Nebraska Department of Water Resources' Forty-Fifth Biennial Report to the Governor. The report lists all appropriations recognized by Nebraska at the end of the 1983-1984 biennium. Below are listed all mainstem appropriations from the Wyoming-Nebraska border downstream to Box Butte Dam. They are not listed according to priority; however, priority dates are shown.

APPROPRIATOR	CARRIER	USE	PROVI GRANT (CFS)	DATE OF PRIORITY
Sioux County				
Ellicott Hereford Ranch, Inc.	Biglow-Seymour Canal	IR	1.20	06/08/1891
Ray T. Dour Ranch & Cattle	Pumps	IR	1.20	06/08/1891
Martin H. & W. Lucille Marshall	Johnson Canal	IR	2.09	05/01/1891

Melvin R. & Klara M. Grote	Lakotah Canal	IR	5.35	10/01/1893
Six Bar Ranch, Inc. et al	Earnest Canal No. 2	IR	2.14	05/15/1891
Six Bar Ranch, Inc. et al	Earnest Canal No. 2	IR	1.46	03/24/1914
Six Bar Ranch, Inc. et al	Earnest Canal No. 1	IR	2.86	05/01/1885
Agate Springs Ranch, Inc.	McGinley-Stover N. Canal	IR	6.73	05/01/1887
Agate Springs Ranch, Inc.	McGinley-Stover S. Canal	IR	1.71	05/01/1890
Agate Springs Ranch, Inc.	McGinley-Stover N. & Cook Canal No. 2	IR	.71	05/31/1891
Agate Springs Ranch, Inc.	Cook South Canal No. 1	IR	2.31	05/31/1891
Agate Springs Ranch, Inc.	Pump	IR	1.48	05/01/1887
Agate Springs Ranch, Inc.	Pump	IR	.52	05/31/1891
Department of Interior	Pump	IR	1.24	12/07/1953
Oscar Skavdahl et al	Harris-Neece Canal	IR	8.57	07/01/1892
Morava, Morava, Morava & Snow, et al	Harris-Neece Canal	IR	7.27	07/11/1932
Morava, Morava, Morava & Snow, et al	Labelle Canal	IR	2.00	03/12/1895
Morava, Morava, Morava & Snow, et al	Labelle Canal	IR	3.14	07/03/1895
George E. Sandoz	Mettlen Canal	IR	4.90	04/27/1896
James L. Skavdahl	Mettlen Canal	IR	.75	12/18/1912
James L. Skavdahl	Mettlen Canal	IR	1.14	10/13/1931
James L. Skavdahl	Davison Canal	IR	.21	04/27/1922
Donald B. Armstrong	Bennett Canal	IR	3.45	12/18/1912
Donald B. Armstrong	Pump	IR	.59	06/20/1966
John J. & Patricia B. Manning	Moore Canal	IR	5.71	07/22/1895
Box Butte County				
Judy K. Preille	Geo. Hitshaw Canal	IR	6.00	02/17/1913

Judy K. Prella	Pump	IR	.76	01/13/1966
Judy K. Prella	Hitsheew Canal No. 2	IR	.60	05/17/1951
Wilkins Ranch, Inc.	McLaughlin Canal	IR	7.14	03/01/1888
Hughes & Wilkins	Excelsior Canal	IR	2.86	05/15/1895
Hughes & Wohlers	Excelsior Canal	IR	1.92	03/28/1932
Hughes & Wohlers	Hughes Canal	IR	.57	05/31/1890
John R. Hughes	Hughes Canal	IR	.30	04/15/1894
Frank L. Dahaven	Pump	IR	8.15	10/19/1950

Dawes County

Wyoming Fuel Company	Pump	MF		08/06/1984
Frances E. Chicoine et al	Pioneer Canals	IR	2.88	08/01/1887
Merle A. Danny & Lila P. Strawder	Pioneer Canal No. 2	IR	.78	03/08/1945
Merle A. Danny & Lila P. Strawder	Pioneer Canal No. 3	IR	.21	02/16/1950
Merle A. Danny & Lila P. Strawder	North Pioneer Canal	IR	.62	08/11/1952
Tomahawk Ranch & Cattle Co	Furman Canal	IR	.37	02/02/1894
Virginia Campbell	Pumps	IR	.53	01/27/1894
Virginia Campbell	Pump	IR	1.10	02/24/1953
Bureau of Reclamation	Box Butte Reservoir	ST 15000.00AF		03/06/1937
Bureau of Reclamation	Box Butte Reservoir	SS 32670.00AF		06/24/1941
Robert Delsing	Pump	IR	1.02	01/13/1981
Robert & Violet Lembke	Montague Canal	IR	.51	11/15/1965
Robert & Violet Lembke	Montague Canal	IR	1.76	03/31/1932
Myron P. & Elmada Lembke	Montague Canal	IR	.43	09/27/1900
Robert & Violet Lembke	Montague Canal	IR	.29	06/14/1937
Rachel D. Korsick	Montague Canal	IR	.60	07/11/1946
Leonard J. Kriz	Lighte Canal	IR	.71	04/19/1911

Charles L. Iodence	Lighte Canal	IR	1.47	01/24/189
Charles L. Iodence	Lighte Canal	IR	2.20	04/07/191
Charles L. Iodence	Lighte Canal	IR	.24	01/02/191
Charles L. Iodence	Lighte Canal	IR	.95	03/02/193
Charles L. Iodence	Lighte Canal	IR	.65	12/28/194
Duane E. Wildy	Potmesil Canal	IR	6.76	10/29/193
Duane E. Wildy	Potmesil Canal	IR	2.07	09/07/196
Charles L. Iodence	Mirage Flats Canal	IR	2.00	03/02/193
Bureau of Reclamation	Mirage Flats Canal	IR	135.78	01/25/1937
Charles L. Iodence	Mirage Flats Canal	IR	1.46	02/11/193
Bureau of Reclamation	Mirage Flats Canal	IR	30.76	05/18/194
Bureau of Reclamation	Mirage Flats Canal	SI		08/05/195
Bureau of Reclamation	Mirage Flats Canal	SI		08/05/195

Note: IR-Irrigation, MF-Manufacturing, ST-Storage, SS-Supplemental storage, SI- Supplemental irrigation

Mr. Robert Bishop, Chief of the Operations Branch, Nebraska Department of Water Resources, stated in a recent telephone conversation that Box Butte Reservoir has not filled for more than 20 years. If that is the case, the Bureau of Reclamation's storage and supplemental storage rights of 15,000 acre-feet per year (3/6/37) and 32,670 acre feet per year (6/24/41), and probably other rights as well, are not being satisfied.

It is noteworthy that in 1962 Nebraska and Wyoming apportioned the waters of the upper Niabrara River. The terms of the apportionment are contained in the attached compact.

Item 4

Display the process for appropriating water in Nebraska; the process for objecting to applications for new water use permits; the responsibilities of park managers and the Water Rights Branch; and recommend actions needed, if any, to secure water rights that were acquired when the Hoffman ranch was purchased.

RESPONSE

Nebraska law gives the Department of Water Resources jurisdiction over all water right matters except those specifically limited by statute (Section 46-209, R.R.S., Nebr., 1943). In short, the Director of the Department has broad ranging authority, particularly with respect to applications for new surface water permits.

Unlike many neighboring states, Nebraska does not automatically provide for public notice when applications for new appropriations are being processed. With few exceptions, applicants receive their permit to put water to beneficial use within 30 days of the Department's receipt of an application and fee (currently \$200).

There is currently in place a moratorium against new appropriations on only two streams in Nebraska: Pumpkinseed Creek (a tributary of the North Platte River) and Lodgepole Creek (a tributary of the South Platte River). If the Department receives an application for water in any other basin, and if the application is complete, then Nebraska law directs the Department to allow the use to be perfected. Section 46-235, R.R.S., Nebr., 1943 reads:

"the Department of Water Resources shall approve the same, by endorsement thereon, and shall make a record of such endorsement in some proper manner in its office and return the same so endorsed to the applicant, who shall, on receipt thereof be authorized to proceed with the work and to take such measures as may be necessary to perfect such application into an appropriation."

The same statute, however, gives the Department authority to impose certain restrictions on the appropriation.

"The Department may, upon examination of such application, endorse it approved for a less period of time for perfecting the proposed appropriation, or for a less amount of water, or for a less amount of land than applied for. The Department may also impose such other reasonable conditions as it deems appropriate to protect the public interest (Section 46-235, R.R.S., Nebr., 1943).

One such condition that is routinely imposed upon new appropriations is that the right to divert is subject to senior appropriations being satisfied first. If at any time an appropriator fails to receive water to which he feels he is entitled, he notifies the Department of Water Resources and the Department conducts a field inspection. Upon finding that a senior appropriator's rights are not being satisfied, the Department issues notices, or closing orders, to junior appropriators to discontinue their diversions. When conditions permit junior appropriators to resume their diversions, the Department follows with another notice suspending the earlier order.

In the absence of a public notice provision for new appropriations, our only recourse, in the event the Service's rights are not being satisfied because of the actions of junior appropriators, is to follow the procedure described above. In view of existing conditions on the upper Niobrara River, however, we can expect that in most years the state will continue to send notices to AGFO to stop diverting for a portion of the irrigation season because more senior appropriators downstream require the water.

According to one official in the Department of Water Resources, Robert Bishop, Chief, Operations Branch, water supply conditions on the upper Niobrara are such that applications for new water uses over the past few years have been very few. Apparently, everyone is aware of the fact that already the stream is heavily appropriated and virtually every summer closing orders will be sent out to protect the senior appropriators.

Finally, Nebraska law does not provide for a change in the purpose of a water use. Originally, we had discussed the possibility of effecting a change for a portion of the irrigation right that was acquired with the Hoffman ranch. At that time, we were unaware of the fact that Nebraska has no provision for change, other than for a change in the point of diversion or the place of use. Therefore, we recommend that you continue the practice of pumping and reporting to the state each year, as before.

Copies of Nebraska's Rules for Surface Water and Rules for Ground Water are enclosed. Also enclosed is a copy of Section 46-229.05, R.R.S., Nebr., 1943, which you may want to read.

If you or your staff have any questions, please contact Scott Brown or myself. We look forward to hearing from you regarding the possibility of applying to Nebraska for an instream appropriation.

Stanley L. Ponce

Stanley L. Ponce

Attachments

cc: D. Scott Brown, WRB-WRD (w/ att)
Richard Ketcham, WSB-WRD (w/ att)
Warren Hill, MWR (w/att)
Michael Ruggiero, MWR (w/att)

FNP:DSBrown:cs:pml:221-5341:9/22/86:20922brw.ag



United States Department of the Interior

NATIONAL PARK SERVICE

WATER RESOURCES DIVISION
301 SOUTH HOWES ST., ROOM 343
FT. COLLINS, COLORADO 80521

IN REPLY REFER TO:

October 23, 1986

L54 (479)
AGFO/General

Memorandum

To: *Thomas W. Lude 10/27/86*
Chief, Water Resources Division

Through: Chief, Water Services Branch

From: Hydraulic Engineer

Subject: Water questions - Agate Fossil Beds National Monument.

By memorandum of May 9, 1986 the Superintendent of Scotts Bluff expressed concern for the water resources of the area in the form of 6 questions. The following material reiterates the questions and provides answers. In that some of the questions involve broad and/or complicated topics, our answers may be considered as preliminary comments. Further investigations or projects will be necessary to provide quantified answers.

Question 1.

Since the National Park Service has taken over the area, great changes have occurred in the river environment. Large marsh areas have formed and in many places it is difficult to determine the main channel of the River. Are these changes the result of natural action, the removal of heavy cattle grazing in the area, termination of dredging, elimination of the impact of historic grazers, the result of periodic tumbleweed dams, or all of the above? What actions should we be taking in regard to the management of this small river.

Answer

This question was partly answered in our memorandum of October 10, from Chief, Water Rights by his flow analysis of gaging stations and partly in following answers to your other questions.

Question 2.

What are the effects upon the river within the park originating outside the park? What is the quality of the river water? Is it heavily laden with pesticides? What is the effect of irrigation on levels of the river?

Answer

The chemical quality of the Niobrara is good. Further downstream at Box Butte there are no unusually high constituents of concern (water quality analysis attached) The dissolved oxygen is near saturation and showing only moderate biological pollution. We nor the USGS have any pesticide information on the Niobrara near Agate. Therefore your closest and best source of information is the Fish and Wildlife Service in Pierre, South Dakota. We have discussed this question with Mr. Chuck Sowards, Comm. 605-224-8693, (FTS) 782-5228, FWS. He felt the best organism to test would be fish, however, sediments might also be useful. He indicated that testing the water would probably not provide adequate analysis due to the volatile nature of many pesticides. We suggest your checking of feed stores to determine what chemicals are being sold/used. This information can then be used to greatly reduce the number of analysis required for an adequate test. Analysis can be done by FWS, each sample will cost about \$175.00. Samples (fish or sediment) should be collected in midsummer. We have a list of legal herbicides and pesticides in eastern Wyoming and will forward them to you if you wish; the number exceeds 8,500 different products.

Question 3.

Do we in fact have any rights in regard to the water in the river or is our major guarantee of instream flow predicted on the fact that there are senior water rights downstream?

Answer

Our memorandum of October 10, dealt with water rights on the Niobrara from Wyoming to Box Butte dam. There are 61 appropriations and 55 of them are senior to our Hoffman Pump right. This is equal to 90%. More than 98% of the senior rights are for irrigation. The total amount of water already allotted is at least seven times the flow of the Niobrara at Agate in Sioux County alone. This is true of many basins including the Colorado in which Indian water rights alone are three times the flow of the river.

Surface waters can and have been appropriated. Our acquired Hoffman Pump right to water from the Niobrara will have to stand on its own merit with other rights to the river water downstream. The downstream water rights may be our best protection of instream flow.

Question 4.

We are often accused of causing great loss of irrigation water due to evaporation and transportation from the marsh area. Is this true?

Answer

We would have to know the time that the land is inundated. By assuming the entire area of the Monument is flooded from January to June from terrace to terrace, it is possible to lose four percent of the total river flow by evaporation from snow, ice and water. Evaporation is decreased by snow and ice as the vapor pressure on frozen surfaces is lower than on water. With a snow or ice temperature of 30°F and a dewpoint of 20°F the evaporation rate is only one-fifth that from a water surface at 80°F when the dewpoint is 70°F, with the same windspeed assumed in both cases. Based upon the above considerations/factors, it appears that the loss of water from the park as evaporation is negligible.

Question 5.

Much of the upstream river area within the park boundaries lie within an area in which the Federal Government holds scenic easement only. We suspect from reading the easement that its terms would not prevent center pivot irrigation equipment from being installed in the park. If this is so, should the easement be strengthened? What would the likely effect on the river be if such equipment were installed?

Answer

A legal opinion regarding the application of center pivot irrigation within the Monument has been requested of the solicitor. This response is expected in the near future.

The USGS, Water Resources Investigation 80-43 by R.A. Engherg states that most of the Niobrara flow in the sand hills is due to groundwater seepage, not from runoff. However, we would expect some of the flow infiltrates to recharge the Ogallala aquifer, at least in some areas. This indicates that during the irrigation season, groundwater withdrawal would definantly effect the flow of the Niobrara, especially if the wells were in close proximity to the river. The drawdown of the irrigation wells will cause groundwater to flow away from the river and into the well.

Question 6

What is the current status of surface versus groundwater laws? Are we sufficiently protected to insure the future domestic water needs of the Monument?

Answer

There is no groundwater law in Nebraska except for irrigation wells which must be spaced in accordance with State regulations. It is our opinion that park domestic systems are safe for the foreseeable future. We presently have 216,000 gallons of water a day available from our headquarters supply well. New potable water sources can be developed by drilling additional well(s) at any location on the Monument that is Federally owned.

Richard A. Ketcham

Richard Ketcham

NIORARA RIVER BASIN

06454500 Niobrara River above Box Butte Reservoir, Nebr.

Location.--Lat 42°27'35", long 103°10'15", in NE¼ sec. 27, T.29 N., R.50 W., Dawes County, Hydrologic Unit 10150002, on right bank 1 mi upstream from high-water line of Box Butte Reservoir and 6 mi east of Marsland.

Drainage area.--1,400 mi², approximately.

Period of record.--July 1975 to current year.

Statistical data for selected chemical constituents

Constituent	Units	No. of measurements	Maximum	Minimum	Mean	Median	Standard deviation	Ninetieth percentile	Tenth percentile
Specific conductance	umho/cm	27	472	358	413	414	28	450	370
Dissolved solids, residue	mg/L	17	325	263	286	282	17	310	270
Dissolved solids, sum	mg/L	9	300	266	281	-----	13	-----	-----
Hardness as CaCO ₃	mg/L	8	180	150	160	-----	12	-----	-----
Calcium, dissolved	mg/L	8	54	45	49	-----	3.8	-----	-----
Magnesium, dissolved	mg/L	8	10	8.1	9.3	-----	0.7	-----	-----
Sodium, dissolved	mg/L	8	37	22	26	-----	4.6	-----	-----
Potassium, dissolved	mg/L	8	8.7	6.3	7.4	-----	1.0	-----	-----
Bicarbonate ion	mg/L	8	270	210	243	-----	21	-----	-----
Sulfate, dissolved	mg/L	8	33	11	16	-----	7.1	-----	-----
Chloride, dissolved	mg/L	25	8.3	3.5	5.3	4.9	1.2	7.1	3.9
Fluoride, dissolved	mg/L	9	0.8	0.6	0.7	-----	0.07	-----	-----
Silica, dissolved	mg/L	8	52	39	47	-----	4.2	-----	-----
Boron, dissolved	mg/L	8	160	40	68	-----	38	-----	-----
Iron, dissolved	ug/L	8	180	0	46	-----	58	-----	-----
Manganese, dissolved	ug/L	8	200	5.0	46	-----	64	-----	-----
Nitrite + nitrate as N, dissolved	mg/L	-----	-----	-----	-----	-----	-----	-----	-----
Nitrate as N, dissolved	mg/L	-----	-----	-----	-----	-----	-----	-----	-----
Nitrate as NO ₃ , dissolved	mg/L	-----	-----	-----	-----	-----	-----	-----	-----
Ammonia N, total	mg/L	28	0.07	0.00	0.02	0.02	0.02	0.05	0.00
Organic N, total	mg/L	28	0.81	0.15	0.43	0.38	0.19	0.71	0.21
Phosphorus, total	mg/L	28	0.12	0.00	0.04	0.04	0.03	0.09	0.01
Phosphorus, dissolved	mg/L	20	0.08	0.00	0.02	0.02	0.02	0.05	0.00
Fecal coliform	col/100 ml	15	1,800	1	-----	66	-----	465	0
Fecal streptococci	col/100 ml	23	4,200	9	-----	56	-----	660	16
Oxygen, dissolved	mg/L	28	16.5	8.2	-----	10.0	-----	13.0	8.5
Biochemical oxygen demand (5-day)	mg/L	26	9.4	0.6	2.9	2.5	1.9	5.2	1.1
pH	pH units	28	7.8	7.1	7.4	7.4	0.2	7.7	7.2
Color	Co - Pt units	9	25	3	14	-----	8	-----	-----

NIORARA RIVER BASIN

06454500 Niobrara River above Box Butte Reservoir, Nebr.--Continued

Results of regression analyses relating concentrations of selected chemical constituents to specific conductance (SpC)

Dissolved constituents (mg/L)	No. of measurements	Regression equation	Correlation coefficient	Percent explained variance	Standard error of estimate (mg/L)
Dissolved solids, residue (RDS)	17	RDS = 0.110(SpC) + 240.947	*0.17	3.0	17
Dissolved solids, sum (SDS)					
Hardness as CaCO ₃ (TH)					
Calcium (Ca)					
Magnesium (Mg)					
Sodium (Na)					
Potassium (K)					
Bicarbonate (HCO ₃)					
Sulfate (SO ₄)					
Chloride (Cl)	25	Cl = 0.003(SpC) + 4.187	*.06	0.42	1.2
Silica (Si)					
Nitrite + Nitrate as N (NO ₂ -NO ₃)					

* Not significant at 95 percent confidence level; the regression equation should not be used to predict the concentration of the dependent variable.

Results of regression analyses relating specific conductance to water discharge (Q)

No. of measurements	Water discharge (ft ³ /s)		Regression equation	Correlation coefficient	Percent explained variance	Standard error of estimate	
	Maximum	Minimum				Log units	Percent
27	86	6.6	SpC = 406Q ^{0.00508}	*0.04	0.20	0.031	7.1

*Not significant at 95 percent confidence level; the regression equation should not be used to predict the concentration of the dependent variable.



United States Department of the Interior

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P.O. BOX 25007
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DENVER, COLORADO 80225

→ Dick [signature]
Ketcham
L-54
Agate

October 23, 1986

NPS.RM.1048

Memorandum

To: Regional Director, Midwest Region, National Park Service,
Omaha, Nebraska

From: Regional Solicitor, Rocky Mountain Region

Subject: Potential Change in Land Usage at Agate Fossil Beds
National Monument

The superintendent of Agate Fossil Beds National Monument has expressed concern regarding the imminent possibility of visual obstruction to the monument by the installation of center-pivot irrigation systems on properties within the monument in which the NPS (National Park Service) has only an easement. Up to now, no problem has arisen, as the land covered by these easements has been used for cattle grazing, a compatible use.

The cattle business in western Nebraska is now in financial distress, and many local cattle ranchers have converted their land to farming, using center-pivot irrigation systems in their operations. The superintendent anticipates that the easement owners may soon request permission, or independently proceed, to establish such systems, and he believes that the systems would be inimical to monument purposes because of their height and size.

You have asked whether the terms of the easement would allow the landowners to install center-pivot irrigation systems.

The United States acquired the subject easements by condemnation. The landowners reserved the following rights in the condemnation instruments:

Ingress and egress across lands . . . for the purpose of maintenance and repair and use of an irrigation system, a portion of the ditches of which pass through said tract;

the United States received:

. . . an easement in and right in perpetuity to restrict the future use and development of [the subject tract]
. . . ;

and the landowners were expressly refrained from the following:

b. Erecting or building any structures on said land, except as may be authorized in writing by the Secretary of the Interior

However, the instruments also provided as follows:

g. [Landowners] . . . shall not be precluded hereby from maintaining and/or constructing any irrigation system done in conformity with good husbandry practices and in accordance with other provisions of this instrument.

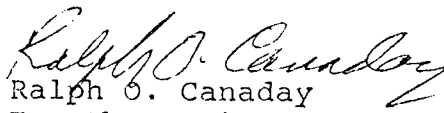
Based upon the language in subclause g. above, the landowner has the right to construct an irrigation system done in conformity with good husbandry practices. Center-pivot irrigation meets this criterion. However, because that provision is qualified by the phrase "in accordance with other provisions of this instrument," it is subject to subclause b., above, which refrain the landowner from erecting or constructing a structure on his land without the written authorization of the Secretary of the Interior.

The purposes of the national monument expressed in the authorizing act are as follows:

. . . to preserve for the benefit and enjoyment of present and future generations the outstanding paleontological sites . . . and nearly related geological phenomena . . . and for the display and interpretation of the scientific specimens uncovered at such sites, and to facilitate the protection and exhibition of a valuable collection of Indian artifacts and relics (Act of June 5, 1965, 79 Stat. 123.)

A center-pivot irrigation system installed on easement land could interfere with the display and interpretation of scientific specimens at sites on the monument. Such would conflict with the purposes for which the monument was authorized.

It is, therefore, my opinion that the landowner must obtain the prior written approval of the Secretary to install or erect a center-pivot irrigation system on easement land. This opinion is based both upon the language in the condemnation instrument and upon the express purpose of the national monument as provided in the authorizing legislation.


Ralph O. Canaday
For the Regional Solicitor
Rocky Mountain Region

Appendix 4

Drillers logs and well driller's report for the domestic supply well and the fire supply well constructed in October 1992 at the maintenance area

Information regarding construction and testing of the wells.

Depth		Description
From	To	
0	5	LOOSE SANDY SOIL MATERIAL
5	10	SANDY SOIL MATERIAL
10	17	LOOSE LIMEROCK & LOOSE SAND TO SOFT SANDSTONE
17	20	LAYERS SILTY SAND & BURIED LAYER BLACK SOIL
20	40	LAYERS LIMESTONE BROWN SILTY SANDSTONE TR GRAVEL
40	60	LOOSE ALLUVIAL LIMEROCK SANDSTONE & GRAVEL
60	80	FINE GRAY ARIKAREE SANDSTONE WITH LIMESTONE LEDGES
80	100	FINE GRAY ARIKAREE SS WITH HARD LIMESTONE LEDGES
100	120	FINE GRAY ARIKAREE SS WITH FIRM LIMESTONE LEDGES
120	140	FINE BROWN TO GRAY SANDSTONE SOME LIMESTONE
140	160	FINE BROWN TO GRAY FIRM SANDSTONE SOME LIMESTONE
160	180	FINE BROWN SILTY SS WITH SOME LIMESTONE STREAKS

Geologic log of domestic supply well near the maintenance building at Agate Fossil Beds National Monument

Nebraska DNR Registration Number G-079953, Well ID 88610

Well constructed October 1992

Depth		Description
From	To	
0	5	LOOSE SANDY SOIL MATERIAL
5	15	LOOSE SAND & TRACE BROWN SANDSTONE
15	30	LOOSE SAND & SOME LIMESTONE ROCK
30	47	LOOSE ALLUVIAL GRAVEL SANDSTONE & LIMESTONE
47	105	ARIKAREE FINE CLEAN SS WITH LIMESTONE LEDGES
105	135	SOFT BROWN SANDSTONE & SOME SOFT LIMESTONE ROCK
135	180	SOFT BROWN SANDSTONE SOME FINE SILTY SANDSTONE

**Geologic log of fire supply well near the maintenance building at
Agate Fossil Beds National Monument**

Nebraska DNR Registration Number G-079952, Well ID 88609

Well constructed October 1992

WATER VAULT DETAIL

NO SCALE

1
M6

NELSON WELLS, Inc.

HC 34 — Box 6A

Alliance, Nebraska 69301

Phone (308) 762-1592

Oct. 29, 1992

TEST PUMPING REPORT

TO: Robert Hamann
Contracting Officer's Representative

FROM: Glenn Nelson
Nelson Wells, Inc.

RE: Agate Fossil Beds National Monument
Well Drilling Contract Order No. 1443PX600032464

The following data provides the test pumping results on the 6" and 10" cased wells for the project records. The results indicate that the well design has been excellent and that the additional screen recommendation seems to have been justified. The ideal pumping condition exists when the production level needed can be produced without reducing the pumping level into the screened portion of the well, as drawdown into the screen may lead to aerated water production.

The screen placement in both wells starts at 90' below the surface. In the 6" well the yield at the screen level is about 138 gallons per minute. The yield in the 10" well was 396 gallons per minute at a pumping level of 76', that was the highest production point tested.

The water is very clean but may yield minor, very fine sand when the wells are started, that subsides quite rapidly, due to the fact we did not use a check valve during test pumping to aid in getting sand removed by surging actions.

The 6" well was pumped for 14 hours on Oct. 8th and 9th, 1992 with yields as listed below:

Static water level	27'6"	Total Depth of Casing 180'
80 Gallons Per Minute	57'	
106 Gallons Per Minute	72'	
131 Gallons Per Minute	85'	
162 Gallons Per Minute	105'	
187 Gallons Per Minute	120'	

The 10" well was pumped for 6 hours on Oct. 23, 1992 with yields as follows:

Static water level	26'	Total Depth of Casing 180'
170 Gallons Per Minute	55'	
209 Gallons Per Minute	57'	
241 Gallons Per Minute	62'	
291 Gallons Per Minute	67'	
350 Gallons Per Minute	72'	
396 Gallons Per Minute	76'	

Nationally Certified Drillers
& Pump Installers

